SUBMITTING PROPOSALS ON DEFENSE NUCLEAR AGENCY TOPICS

The Defense Nuclear Agency is seeking Small Business firms with a strong research and development capability and experience in nuclear weapons effects and nuclear weapons phenomenology areas. Proposals should be submitted to:

Headquarters
Defense Nuclear Agency
Attn: AM/SBIR
6801 Telegraph Rd.
Alexandria, VA 22310

Questions concerning the research topics should be submitted to:

James Gerding
(202) 325-1217

Defense Nuclear Agency
FY 1990 Topic Descriptions

DNA90-001 TITLE: Nuclear Weapon Effects Calculation

CATEGORY: Exploratory Development

OBJECTIVE: Improve the accuracy and/or runtime of nuclear weapon effects calculations.

DESCRIPTION:
General – The accurate calculation of nuclear weapon effects is a major concern of DNA. Areas of interest include more accurate calculations, faster running calculations, microcomputer versions to enable use by a wide audience, and new and improved ways to enable users to calculate, estimate, and appreciate nuclear weapon effects. Nuclear weapon effects include air blast; ground shock; water shock; cratering; thermal radiation; neutron, gamma and x-ray radiation; electromagnetic pulse; fallout; blueout; blackout; redout; dust cloud formation; and the effects of these on personnel. Also of interest is calculating the response of materials and structures to these effects.

Phase I – Demonstrate the feasibility of the proposed methodology to calculate nuclear weapon effects.

Phase II – Fully develop the proposed methodology and, if appropriate, incorporate into appropriate codes.

DNA90-002 TITLE: Response of Materials to Nuclear Weapon Effects

CATEGORY: Exploratory Development

OBJECTIVE: Measure the response of new and existing materials to nuclear weapon effects and develop methods to improve the survivability of these materials.

DESCRIPTION:
General – Of interest to DNA is the response of materials, structures, and systems to nuclear weapons effects. Materials of interest include metals, ceramics and composites. New materials capable of being used as a structural members for aircraft, missiles, ships, submarines, and military vehicles are of particular concern. The response of underground structures such as missile silos, command and control facilities and communications facilities are especially important. Concepts and techniques which will improve the survivability of these types of systems to nuclear weapons effects are required.

Phase I – Develop the testing plan and conduct feasibility studies on the material.

Phase II – Test the material and develop any conclusions from the test results.

DNA90-003 TITLE: Nuclear Weapon and Neutral Particle Beam Effects on Electronics and Communications

CATEGORY: Exploratory Development

OBJECTIVE: Explore the effects of nuclear weapons and neutral particle beams on electronics and communications.

DESCRIPTION:
General – The nature and magnitude of the effects produced by the interaction of nuclear weapon produced radiation and neutral particle beams on electronics, electronic systems, opto-electrical devices and sensors in the phenomenology areas are of interest to DNA. Particular areas of concern include; methods by which designers of space, strategic and tactical systems can assess their susceptibility to TREE, EMP, and SGEMP; hardening technology to reduce the susceptibilities of electronic systems and devices (especially those with submicron feature sizes) to acceptable levels; and methods to demonstrate survivability under specified threat criteria. Concepts and

techniques to improve the survivability (decrease the response) of systems against these nuclear weapons effects and neutral particle beam are required.

Phase I – Conduct initial feasibility studies to demonstrate the viability of the proposed approach.

Phase II – Continue the investigation began in Phase I to fully develop the proposed approach.

DNA90-004 TITLE: Nuclear Weapon Effects Simulation

CATEGORY: Exploratory Development

OBJECTIVE: Improve state-of-the-art in nuclear weapon effects simulation.

DESCRIPTION:
General – International treaties preclude the testing of nuclear weapons in the atmosphere and hence it is not possible to test military systems in an actual nuclear environment. To compensate for this, other testing methods are used to simulate the effects of the nuclear detonation. Nuclear weapons effects simulation includes: high explosive testing to simulate the mechanical effects, EMP simulation, thermal radiation simulation, and nuclear radiation simulation. Simulation techniques should be as realistic as possible, relatively inexpensive to perform and comparable to the threat environment. One should become familiar with existing programs to see how they can be improved and/or combined in order to make the total process more realistic and more representative of the actual nuclear weapons effect being studied. Both destructive and non-destructive test methods are desired.

Phase I – Demonstrate the feasibility of the proposed simulation technique.

Phase II – Develop the simulation technique to include technical and cost comparisons with existing techniques.

DNA90-005 TITLE: Instrumentation

CATEGORY: Exploratory Development

OBJECTIVE: Develop new instrumentation or make improvements to existing instrument used in nuclear weapon effect simulators and in underground nuclear testing.

DESCRIPTION:
General – Instrumentation is used for measuring nuclear weapons effects, phenomenology parameters and the response of test items exposed to real or simulated nuclear weapon effects produced by underground testing or in an above ground simulator or in a water shock test. The instrumentation should be capable of operating under very harsh conditions, such as might be encountered in underground nuclear tests, high explosive tests, or tests involving high levels of x-ray, gamma, or neutron radiation. The instrumentation should survive long enough to record the needed data and include recording, data transmission and data analysis capabilities. Innovative concepts are required for new instrumentation such as gauges fail or perform inadequately. Calibration facilities are needed to calibrate existing gauges in every environment where the gauge could likely be used.

Phase I – Demonstrate the feasibility of the proposed instrumentation.

Phase II – Demonstrate the instrumentation in its working environment. This will involve coordination with DNA to schedule testing in a simulator or underground nuclear test.

DNA90-006 TITLE: Directed Energy Effects

CATEGORY: Exploratory Development

OBJECTIVE: Investigate the effects of directed energy and identify materials which may survive effects of directed energy weapons.

DESCRIPTION:
General – The effects of directed energy sources on materials, structures and systems are of interest to DNA. Of particular interest is the establishment of the correlation between nuclear weapons effects and directed energy effects, the identification of materials which are capable of withstanding both nuclear weapons effects and directed energy effects, and mechanisms by which the directed energy sources actually interact with target materials/structures.

Phase I – Demonstrate the feasibility of the proposed investigation.

Phase II – Characterize the effects of directed energy on materials, structures, etc.

DNA90-007 TITLE: Nuclear Hardening and Survivability

CATEGORY: Exploratory Development

OBJECTIVE: Develop techniques to improve the nuclear hardening and survivability of defense systems.

DESCRIPTION:
General – Techniques for nuclear hardening and survivability of systems/structures against nuclear weapons effects and, where compatible, directed energy effects are required. These techniques should protect the structure or system against the combined effects of blast, thermal and nuclear radiation in the cases of structures of materials, and should also provide protection against electromagnetic and radiation effects wherever any electronic capabilities are involved. In particular, the ability to harden communications facilities and surveillance sensors against electromagnetic pulses is required. Systems include planned and operational strategic and tactical ground mobile systems, missiles, aircraft, spacecraft and their subsystems and components.

Phase I – Demonstrate the feasibility and usefulness of the proposed technique.

Phase II – Fully develop the proposed technique and characterize it usefulness in both technical and cost terms.

DNA90-008 TITLE: Security of Nuclear Weapons

CATEGORY: Exploratory Development

OBJECTIVE: Improve the security of US nuclear weapons against all types of threats.

DESCRIPTION:
General – Measures to improve the security of nuclear weapons against all possible threats are required. These methods are expected to include weapons storage facility designs, transportation facility designs, new security sensor and sensor system development, methods to improve the secure handling of nuclear weapons, and methods to improve the effectiveness and efficiency of nuclear weapon security operations. Proposals should describe how they will improve protection against known and predicted threats and should emphasize weapon concealment where appropriate.

Phase I – Demonstrate the feasibility and potential usefulness of the proposed security measures.

Phase II – Fully develop the proposed security measures so they can be compared to existing techniques.

DNA90-009 TITLE: Theater Nuclear Forces (TNF) Survivability

CATEGORY: Exploratory Development

OBJECTIVE: Improve the survivability of US nuclear weapons.

DESCRIPTION:
General – The pre-launch survivability (PLS) of the TNF is of vital concern. New and innovative concepts to improve PLS are needed to retain a viable nuclear strike capability and to enhance deterrence. The threats to the TNF include enemy forces conducting unconventional, conventional, chemical and nuclear warfare during periods of peacetime, transition to war, and war. Long-range program thrusts include peacetime and field storage, deceptive/OPSEC practices, theater nuclear force movements, and operational survivability of theater nuclear systems. Survivability concepts are warranted for the period of the 1990's and beyond. Concepts should employ innovative ideas and make use of new and emerging technologies.

Phase I – Demonstrate the feasibility and potential usefulness of the proposed survivability measures.

Phase II – Fully develop the proposed survivability measures so they can be compared to existing techniques.

DNA90-010 TITLE: Operational Planning and Targeting

CATEGORY: Exploratory Development

OBJECTIVE: Improve the ability of US nuclear commanders to plan for nuclear engagements and target their nuclear weapons.

DESCRIPTION:
General – The nuclear employment planning capabilities of operational commanders in tactical, strategic and integrated warfare environments should be improved. Improvements desired include development of automated planning systems, techniques to determine target damage objective and criteria, post strike target damage assessment capabilities, and automated nuclear weapon employment codes.

Phase I – Develop the proposed technique in sufficient detail to demonstrate its feasibility.

Phase II – Continue the development of the proposed technique to the point it can be incorporated into existing planning/targeting methodologies.

DNA90-011 TITLE: Underground Nuclear Testing

CATEGORY: Exploratory Development

OBJECTIVE: Improve the design, execution, and evaluation of underground nuclear tests.

DESCRIPTION:
General – Underground nuclear effects tests are used in situations for which no suitable above ground simulator exists. Areas of interest include improvements in the design and execution of tests, the design of new experiments which extend the capability of current test beds, and innovative test concepts to meet future needs. To improve our understanding of the results improvements to the mathematical methods used to perform various calculations within the test design and analysis program are needed. New methods of characterizing existing materials which are using in critical portions of the test bed (such as the A box) and new materials for such applications, new approaches to the geological problems encountered in the construction of the test beds, and new methods for all test activities are also areas of interest to DNA.

Phase I – Demonstrate the feasibility of the proposed test/experiment improvement. This will be done using laboratory and/or above ground testing.

Phase II – Demonstrate the proposed techniques with underground nuclear testing and/or above ground testing.

DNA90-012 TITLE: Verification Technology Development

CATEGORY: Advanced Development

OBJECTIVE: Improve the US and Soviet capabilities to verify existing and proposed nuclear treaties.

DESCRIPTION:
General – New arms control measures are being negotiated which could drastically alter existing inventories of nuclear weapons. New verification technologies and methods will be required to accurately monitor compliance to the provisions of any treaties or agreements that could result from the on-going negotiations. The problem will basically involve being able to distinguish between permitted activities and prohibited activities where the technical signatures between the two could be very minor.

Phase I – Demonstrate the feasibility of the proposed technology.

Phase II – Develop a proof of design to demonstrate the proposed technology.

DNA90-013 TITLE: Nuclear Weapon Effects on Propagation

CATEGORY: Exploratory Development

OBJECTIVE: Investigate the effects of nuclear weapon explosions on electromagnetic propagation with specific interest in communications, radar, and

DESCRIPTION:
General – The Defense Nuclear Agency is interested in the basic physical processes which describe the interaction of electromagnetic radiation with a nuclear perturbed atmosphere. Part of DNA's mission is to predict effects on and determine mitigation methods for DOD systems such as satellite communications, VLF/LF communications, HF/VHF communications, radar systems and sensor systems. Areas of interest include mechanisms for the coupling of nuclear weapon energy to the atmosphere; physical and chemical phenomena arising from nuclear detonations; natural analogs of nuclear environments and processes; predictions of the performance of communications, optical, infrared, ultraviolet, radar and directed energy systems in the nuclear environment; techniques to mitigate nuclear effects on DOD systems mentioned above; unique instrumentation to measure or simulate nuclear effects; and experiments to study naturally disturbed atmosphere as it would related to nuclear environments.

Phase I – Demonstrate the feasibility of the proposed investigation to better the understanding, mitigating, measuring, or simulation of the effects.

Phase II – Continue the investigation t the development of a product that can be incorporated into the existing technology base.

DNA90-014 TITLE: Tactical Application of Pulsed Power Technology

CATEGORY: Exploratory Development

OBJECTIVE: Development of new applications of existing pulse power technology.

DESCRIPTION:
General – Recent advances in energy storage and switching now make possible the application of DNA pulsed power technology to such areas as armor/anti-armor; electromagnetic/electro-thermal guns; mine-countermine; air,

surface, and subsurface systems; high power microwave weapons; etc. Concepts proposed should be highly innovative and make full use of the emerging pulse power technology.

Phase I – Demonstrate the feasibility of the proposed pulsed power application.

Phase II – Continue the development of the concept to an engineering model and conduct tests of the effectiveness of the idea.

DNA90-015 TITLE: Advances in Pulsed Power Technology

CATEGORY: Exploratory Development

OBJECTIVE: Dramatic Improvements in energy storage, switching, and power conditioning state of technology.

DESCRIPTION:
General – Future requirements for systems employing pulsed power will necessitate improvements in efficiency, energy density, reliability, and performance. Innovative approaches for component or subsystem development are sought to meet the needs of radiation simulators and tactical applications requiring operation at kilovolts to megavolts, kilo amperes to mega amperes, and repetition rates from single pulse to 10 kilohertz.

Phase I – Demonstrate the feasibility of the proposed concept.

Phase II – Develop, test, and evaluate proof-of-principle hardware.

DNA90-016 TITLE: X-Ray Nuclear Weapons Effects Source Development

CATEGORY: Exploratory Development

OBJECTIVE: Innovative concepts for the production of x-ray radiation used in nuclear weapon effects testing.

DESCRIPTION:
General – Future requirements for x-ray nuclear weapon effects testing will require vast improvements in existing radiation source capability as well as new concepts for producing soft x-rays, warm x-rays, and hot x-rays. Soft x-rays are used for optical and optical coatings effects testing. Warm x-rays are used for thermo-mechanical and thermo-structural response testing; and hot x-rays are used for electronics effects testing. The proposer should be familiar with the present capability to produce x-rays for weapon effects testing.

Phase I – Demonstrate the feasibility of the proposed concept.

Phase II – Develop, test, and evaluate proof-of-principle x-ray source capability.

DNA90-017 TITLE: Response of In-situ Rocks to Nuclear Weapons Effects

CATEGORY: Exploratory Development

OBJECTIVE: Development of methods to measure material properties of in-situ rock and the incorporation of this data in ground shock/ground motion models.

DESCRIPTION:
General – Present techniques used to define material properties of in-situ rocks generally consist of testing high quality, in tact core samples in a laboratory and then degrading those laboratory derived properties by a measure of rock quality to better represent the in situ material. Techniques are needed tat more directly assess or replicate the response of in situ rocks to ground shock; including field observations and measurements, laboratory testing, and material modeling of in situ quality rocks.

Phase I – Conduct feasibility studies to demonstrate the viability of the proposed research.

Phase II – Implement the proposed technique(s) in the field, laboratory, explosive tests, and/or in first principle code calculations.